

## A New Distribution Area of Taurus Fir (*Abies cilicica* Carr.) in Turkey

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### Abstract

Taurus fir (*Abies cilicica* Carr.) is one of the four native fir species of Turkey, where the Taurus Mountains are the main distribution area. According to literature, the natural habitat area is to be found in the provinces of Antalya, Mersin, Adana and Kahramanmaraş. Recently, we identified a discrete population of this species in Mazdaliyayla region, Çubuklu village of Yahyalı district, Kayseri province.

In this paper, both the recently discovered population of Taurus fir is presented and some observations and findings are described. This new growing area of Taurus Fir is localized in the range of 38°07'27"-35°13'59", 38°07'52"-35°15'40" and 38°08'19"-35°15'13". The vertical range of Taurus Fir is between altitudes of 1,560 and 1,780 m. The aspect of the area is north-northwest. The total area of fir trees in this new range is 42 ha. In this forestry region, three 10x10 m experimental plots are established. According to the measurement results, the diameter of trees is between 8 cm and 59 cm while the height of trees is between 200 cm and 1,130 cm. The soil has middle textures and low amount of organic material. It is sandy loam-clayey loam, slight-middle alkaline, and salt-free according to the laboratory results. There is a 3-5 cm dead coat-humus layer on the soil surface. It was observed that improper cutting of large diameter fir trees had been performed in the past years. But recently, no anthropogenic damages for the fir trees in the area are seen.

The identification of this new fir forest has a very distinct significance due to the contact to steppe vegetation.

**Keywords:** Taurus Fir, Distribution Area, Central Anatolia, Çubuklu Village

### Introduction

Taurus Fir (*Abies cilicica* Carr.) is one of the four kinds of fir trees which naturally grow in Turkey, and it spreads out in Mediterranean region of Anatolia. Taurus Fir has the privilege of being the only functional shade-tolerant tree of this large region except the oriental beech, which has a limited spread in East Mediterranean. Having this property, Taurus Fir is confused with the light-demanding trees in this region except its pure or purified stand in limited areas, and it forms interesting stand that has biological harmony (Bozkuş, 1988). Taurus Fir is also called "**İledin**" by the indigenous people of South Anatolia.

Taurus Fir naturally grows in the Mediterranean forest region in the south of Turkey, especially on steep, high, and karst lands, west-middle Taurus sierras, and Antitaurus (Davis, 1965; Anşin ve Özkan, 1993) and Amanos Mountains. In this large range, the westernmost part is Katran and Kırkok Mountains which are in the south of Bucak (30° 35'), the easternmost border is the Öksüz Mountain which is in the north-east part of Kahramanmaraş (37° 18'), the southernmost border is the Karatepe Mountain in the east part of Gazipaşa (36° 12'), and the northernmost border is the Aygörmez Mountain in the east part of Kayseri (38° 35') (Bozkuş, 1988). Its

altitudinal ranges in Taurus mountains is generally from 1,150 m up to 2,000 m (Boydak ve Erdoğan, 1999).

Taurus Fir splits into two sub-species in its growing area. The first subtype "*Abies cilicica* subsp. *isaurica*", which grows in the west Mediterranean region (Antalya and Konya), has glabrous young shoots and buds contain resin abundantly. The second subtype "*Abies cilicica* subsp. *cilicica*", which grows in the east Mediterranean region (Mersin, Adana, Kahramanmaraş, and Hatay), has hairy young shoots and buds without resin (Bozkuş, 1988; Pamay, 1992; Boydak ve Erdoğan, 1999).

This paper introduces the new growing area of Taurus Fir, which has a localized growing area penetrating into the steppe, and presents some observations and determinations devoted to its types.

### Material and Method

In this paper, the authors went to Mazdaliyayla locality of Çubuklu Village of Yahyalı county of Kayseri, where Taurus Fir's penetration amount into steppe is maximum, and they made observations and determinations devoted to the area and fir type.

The properties of this type such as geographical position (latitude-longitude), aspect, altitude, slope, landforms, and climate

are determined. Cross-sections of fir trees were taken from two different altitudes for age determination.

Two soil profiles were dug up and soil samples were taken in order to determine the soil properties of the area. The soil samples were obtained depending on depth (at every 30 cm starting from 0 cm).

The composition form of the Taurus Fir units in the area, the status with respect to the forest management planning, the distance to the nearest natural Taurus Fir forest and major residential location, and anthropogenic effects were inspected. Also, three 10 x 10 m plots were inspected at three different altitudes (1770 m, 1670 m, and 1570 m) in this new distribution area of fir. Species, number, diameter and height, with habitude information of all trees in these plots were designated. The trees having a dbh of minimum 8 cm were measured. The diameter measurements were done with a diameter measuring tape of an accuracy of 1 cm. The tree heights were measured with a lath-

height scale of 1 cm accuracy (Yıldızbakan ve Saraçoğlu, 2004). The altitude, aspect and coordinates were determined with a GPS device.

### Results and Discussion

The new distribution area of Taurus Fir is in Mazdalıyayla locality of Çubuklu village, Yahyalı county of Kayseri in Central Anatolia. This area has a distance of 90 km to Kayseri, 18 km to Yahyalı and 4 km to Çubuklu village. This indicates that Taurus Fir tree has a wide and scattered range covering different local surrounding conditions (Bozkuş, 1988).

The Fir trees identified in this area have hairy young shoots and buds without resin. This type which has a new growing area can be called “*A. cilicica* subsp. *cilicica*” according to Bozkuş (1988) referring to Coode and Cullen.

This area remains in B5 square according to Davis’s grid system (Davis, 1965). This new range of Taurus Fir is localized in the coordinates of 38°07'27"-35°13'59", 38°07'52"-35°15'40" and 38°08'19"-35°15'13" (Figure 1).



**Figure1.** Maps showing the range of the new Taurus Fir area (Dağdelen, 2012)

This forest area is part of the Kayseri Forest District, Yahyalı Forest Range, forest compartments numbered 16-17-18 and 19. The stand types of these four divisions are determined as “ÇBMBt” according to the 1991-2010 “Yahyalı forest management planning” (Anonymous, 1991). But

according to the plan modification report prepared in 1997, the stand types and the areas are changed as shown in Table 1 (Anonymous, 1997). Fir species in this area generally forms pure stands or partially mixed stand with oak.

**Table 1.** Area Table

Compartment No.	Stand Type	Area of Forest Land (ha)	Non-forest Land (ha)		Total Area (ha)
			Symbols	Area	
16	Gab3	10.0	Z-OT-1	7.0	49.0
	ÇBMBt	25.0	Z-OT-2	7.0	
17	Gab3	16.0	Z-OT	15.0	50.0
	ÇBMBt	19.0			
18	Gab3	4.0	Z-OT	20.0	71.0
	ÇBMBt	44.0	Z	3.0	
19	Gab3	7.5	Z-OT	26.0	62.5
	GMab3	5.0	Z	4.5	
	ÇBMBt	19.5			
<b>Total</b>	Fir	<b>42.5</b>		<b>82.5</b>	<b>232.5</b>
	Oak	107.5			

The distribution area of Taurus Fir is shortly stated in Flora of Turkey prepared by Davis in 1965. The most extensive and detailed information about the natural range of Taurus Fir was provided by Prof. Dr. Ferhat Bozkuş in 1988. However, there is no evidence of fir forest in Mazdalıyayla locality of Çubuklu village in these two research studies and maps.

The vertical distribution area of Taurus Fir is between altitudes of 1,780 and 1,560 m, and it

forms 3 crown layer forests at higher altitudes with oak trees where the fir tree dominates in number. At lower altitudes, the fir number gets lower and the oak trees dominate. Below 1,560 m, cull oak trees are totally dominant. The aspect of the area is northwest-north (Figure 2). The slope of the area is generally high; it is typically 80-90 % in high altitudes and it drops to 50-60 % in lower altitudes.



**Figure 2.** General views from the Taurus fir stand (Dağdelen and Keleş, 2012)

Terrestrial climate is dominant in Central Anatolia. The climate type is determined by the 22-year measurement data of Develi Meteorological Station which is the nearest station to the area at 1,180 m. The area has a semi-arid climate according to de Martonne Index (1942). Monthly average temperature is between -0.8 °C to 29.2 °C where the annual average temperature is 16.8 °C. Monthly average

rainfall is between 3.7 mm and 57 mm where the annual average rainfall is 368 mm. From June to November the soil is “water inadequate” according to Thornthwaite Water Statement Diagram (Sayhan, 2006).

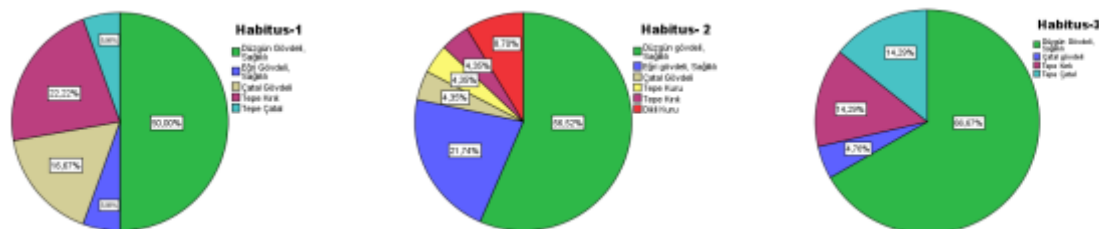
In this forestry region, some measurements regarding the stands were made in three 10 x 10 m plots (Table 2).

**Table 2.** Taurus Fir's measurements in the trial areas (10 X 10 m)

Trial Area No.	Alt. (m)	Species	Total tree in the trial area	Number of stems per ha	Diameter measurement (dbh) (cm)			Height measurement (cm)			Habitus and Rate
					Min	Max	Average	Min	Max	Average	
1	1770	Fir	18	1,800	8	59	18	200	1130	567	%50 straight bole-stem, healthy
		Oak	1	100			20			630	
2	1670	Fir	23	2,300	8	22	11	420	710	622	%57 straight bole-stem, healthy
		Oak	9	900	8	16	18	590	910	664	
3	1570	Fir	20	2,000	8	17	13	210	690	547	%67 straight bole-stem, healthy
		Oak	3	300	6	7	7	290	510	436	

According to these measurements, the habit and health state of the trees are better in the lower altitudes (Figure 3). At higher altitudes,

the forests are formed by thicker trees while at lower altitudes younger trees dominate the forests.



**Figure 3.** Taurus Fir's habitus and health rates in the trial areas

Cross-sections were taken from two withered trees located in two different altitudes and cut from  $d_{1,60}$  level years ago. The tree ages were determined by the Lintab-5 device since the growth rings are very dense in the obtained cross-sections. The first tree taken from the altitude of 1,750 m has a  $d_{0,30}$  of 52 cm, while the second tree taken from the altitude of 1,670 m has a  $d_{0,30}$  of 15 cm. According to the measurement results the age of the first tree

is found to be 163 years and the age of the second tree is found as 106 years. The observation in the two cross-sections showed that the growth rings become very dense in the further ages. The two trees, which the cross-sections are obtained from, have eccentric stem formation (Figure 4). The reason of this eccentric stem formation is considered to be the structure of the tree branches and high surface declination.



**Figure 4.** Fir stem cross-sections (Keleş, 2012)

Soil samples were obtained from two different altitudes (1,670 and 1,545 m) in order to define the soil structure of the area. The soil has medium texture and low amount of organic material, it is sandy loam-clay loam, slight-medium alkaline, and salt-free according to the laboratory results (Anonymous, 2012). There is a 3-5 cm litter-humus layer on the soil surface (Figure 5a). The fixed depth is measured as 50 cm in the first soil profile (1,670 m) and 60 cm in the second soil profile (1,545 m). The effective rooting depth is determined as 70 cm and 90 cm, respectively. The deep fractured

structure as in Taurus Mountains is not seen in this area. Main rock is observed after 50 cm depth in the first soil profile, while schist layer is observed after 60 cm depth in the second soil profile.

The root of the trees spread in 0-50 cm depth in the first soil profile (1,670 m), while they spread in 0-60 cm depth in the second soil profile (1,545 m). After these depths (60 cm) no root spread is observed. This indicates that the effective rooting depth is shallow (Figure 5b and 5c).



**Figure 5a-b-c.** Humus layer - litter and root distributions into the soil (Keleş, 2012)

Very narrow annual rings in the cross-sections and little tree height developments suggest that the soil conditions are more influential than the climate effects. The small age of the trees in the second and third plots shows that the depth problem in the soil has not started yet.

When the anthropogenic effects are considered, it is observed in the field that cutting of large diameter fir trees was performed in the past years. It is seen that the trees are cut improperly at the height of 1.00-1.60 m and the side sprays form the stems (Figure 6). There are no anthropogenic effects for the fir trees in the area related to the recent times.



Figure 6. Irregular cuts in the thick diameter trees (Keleş, 2012)

### Conclusion and Suggestions

Although the natural range of Taurus Fir is in the south of Turkey and in Mediterranean forest region, it is determined that the species has a newly localized range in the steppe of Central Anatolia. This area where the Firs form a forest is in Mazdalıyayla locality of Çubuklu village of Yahyalı county of Kayseri. This situation indicates that Fir tree has a wide and scattered range which shows different local surrounding conditions.

The Fir trees identified in this area have hairy young shoots and buds without resin. This type which has a new distribution area can be called “*A. cilicica* subsp. *cilicica*”

This area remains in B5 square in Davis’s grid system (Davis, 1965). This new distribution area of Taurus Fir is localized in the range of 38°07'27"-35°13'59", 38°07'52"-35°15'40" and 38°08'19"-35°15'13".

According to de Martonne Index (1942), the area has a semi-arid climate. Annual average temperature is 16.8 °C. and annual average rainfall is 368 mm. According to Thornthwaite Water Statement Diagram, the soil is “water inadequate” from June to November.

This forest area is part of Kayseri Forest District, Yahyalı Forest Range, forest compartments numbered 16-17-18 and 19.

The vertical distribution area of Taurus Fir is between altitudes of 1,780 and 1,560 m. The slope of the area is generally high; it is typically 80-90 % in high altitudes and it drops to 50-60 % in lower altitudes.

Fir species in this area generally form pure stand or partially mixed stand with oak. Stand type is Gab3. The Fir forest is three crown cover. The two fir tree ages were determined as

103 and 163 years. The dbh of fir trees varies between 8 cm and 59 cm. The height of fir trees is between 200 cm and 1,130 cm.

The soil has medium textures and low amount of organic material; it is sandy loam-clay loam, slight-medium alkaline, and salt-free.

The reason for Taurus Fir in this new area not having enough diameter and height (max. diameter 59 cm and max. height 1,130 cm) compared to values in the optimum range is considered to be the fixed depth and effective rooting depth of the soil together with the climate factor.

Taurus fir forms a mixed forest with oak trees in this new range, as it forms mixed stands with oak trees in the Mediterranean forest region. This structure should be protected when the stand dynamics is considered. Besides, it is important for our forestry to protect a species that has penetrated into steppe and adapted to the region and extreme climate conditions.

When the anthropogenic effects are considered, it is observed in the field that the cutting of large diameter fir trees was performed in the past years. There are no anthropogenic effects for the fir trees in the area related to the recent times.

There will be different subjects about the stand that should be studied since this work targets to provide information about the new range of Taurus Fir and create a scientific background on the topic. For example, these subjects could be: the stand profile to determine stand structure, the identification of the growth relations, studies on cones and seeds, genetic research, etc.

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